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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/750,059	12/30/2003	Hiroshi Miyazaki	TI-36833	9129

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EXAMINER

LE, THAO X

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 09/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/750,059

Applicant(s)

MIYAZAKI, HIROSHI

Examiner

Thao X. Le

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 July 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,4,6,8-11 and 28-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,6,8-11 and 28-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 30, 32, 33 rejected under 35 U.S.C. 102(b) as being anticipated by US 5666270 to Matsuda et al.

Regarding claim 30, Matsuda discloses a semiconductor device in fig. 7A-F comprising: a substrate 31; a conductive contact pad 36 having a first elastic modulus, disposed over the substrate 31, having an inner portion (top) and an outer portion (vertical) of the same conductive material 36, the inner portion having a first thickness, the outer portion having a second thickness greater than the thickness and enclosing the inner portion; a compliant layer 35 having a second elastic modulus lower than the first elastic modulus, disposed directly under the contact pad 36, covered by the inner portion of the contact pad and contacting the outer portion of the contact pad.

Inherently, the metal layer 36 would have higher elastic modulus than polymer 35.

Regarding claims 32 and 33, Matsuda discloses the semiconductor device wherein the outer portion has a first bottom portion surface, the compliant layer 35 has a second bottom surface, and the first and the second bottom surface are co-planar, fig.

7F, and wherein the compliant layer 35 has a thickness greater than the second thickness, fig. 7F.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 1, 4, 8-11, 28-29 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5666270 to Matsuda et al. in view of US 6919264 to Brintzinger et al.

Regarding claim 1, Matsuda discloses an interconnect structure in fig. 7A-F comprising: a substrate 31; a conductive contact pad 36 having a first elastic modulus disposed over a portion of the substrate surface 31, having an inner portion (top) and an outer portion (vertical), the outer portion of the conductive contact pad completely surrounding the inner portion of the conductive pad; a compliant layer 35 having a second elastic modulus lower than the first elastic modulus (metal modulus of metal 36 vs. polymer modulus of resin 35), disposed directly under the inner portion of the contact pad, the inner portion of the contact pad over the compliant layer 35 having a thickness thinner than the thickness of the outer portion of the contact pad; and an insulative mask 37, disposed over the contact pad 36, including an opening, that exposes the inner portion of the contact pad, fig. 7F.

But, Matsuda does not expressly disclose the compliant layer is not under the outer portion of the contact pad.

However, the inner portion is a portion including curvature portion, such consideration would obviously meet the claim limitation. In addition, Brintzinger discloses a compliant layer 2 is only under the inner portion of the contact pad, fig. 6. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the compliant teaching of Brintzinger with Matsuda's device, because it would have provided a better surface contact or for optimization purpose. In re Dailey 149 USPQ 47, 50 (CCPA 1966). See also Glue Co. v. Upton 97 US 3,24 (USSC 1878). See In re Aller, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955).

Regarding claim 4, Matsuda discloses the interconnect structure in which the contact pad 36 comprises gold and the compliant layer 35 comprises a material having an elastic modulus lower than the elastic modulus of metal, see discussion in claim 1.

But Matsuda does not disclose the interconnect structure in which the contact pad 36 comprises copper.

However, Brintzinger discloses the semiconductor device wherein the interconnect structure in which the contact pad (layer 4-7) comprises copper and gold. At the time of the invention was made; it would have been obvious to one of ordinary skill in the art to use the contact pad material teaching of Brintzinger with Matsuda, because it have provided the same purpose, MPEP 2144.06.

Regarding claims 8-10, Matsuda discloses the interconnect structure in which the inner portion of the contact pad is more flexible than the outer portion (inherently, the thicker portion would be more rigid than the thinner portion), wherein the opening uncovers a substantially planar contact surface, fig. 7F, wherein the structure further including a solder contact 14, fig. 1, attached to the contact surface, fig. 1, the solder contact 14 including a contact portion defined by the opening of the insulative mask 37.

Regarding claim 11, Matsuda discloses the interconnect structure wherein the thickness of the compliant layer 35 is greater than the thickness of the outer portion of the contact pad 36.

Regarding claims 28-29, Matsuda discloses the interconnect structure wherein the contact pad comprises a conductive metal (Au) and the compliant material 35 comprises a polymer, wherein the compliant layer 35 comprises a dielectric material (polymer is dielectric).

Regarding claim 31, Matsuda does not disclose the semiconductor device in which the inner portion and the outer portion of the contact are co-planar.

However, Brintzinger discloses the semiconductor device in fig. 6 wherein the inner portion layer 4 in contact with compliant layer 2 and the outer portion of the contact are co-planar. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the teaching of Brintzinger with Matsuda's device, because such configuration have provided a better surface contact. In re Dailey 149 USPQ 47, 50 (CCPA 1966). See also Glue Co. v. Upton 97 US 3,24 (USSC 1878).

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over US 5666270 to Matsuda et al. and US 6919264 to Brintzinger et al. as applied to claim 1 above and further in view of US 5187020 to Kwon et al.

Regarding claim 3, Matsuda discloses the interconnect structure wherein the contact pad comprises a conductive metal 36.

But Matsuda does not disclose the interconnect structure wherein the compliant layer 35 comprises a metal

However, Kwon discloses a interconnect structure wherein the compliant layer 15 comprises a metal (conductive), col. 3 lines 10-11. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the compliant layer teaching of Kwon with Matsuda's device, because it would have created a contact adequately compressed to assure a good, solid electrical contact and without permanent deformation of the compliant material as taught by Kwon in col. 3 lines 22-28.

6. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over US 5666270 to Matsuda et al. and US 6919264 to Brintzinger et al. as applied to claim 1 above and further in view of US 6211572 to Fjelstad et al.

Regarding claim 6, Matsuda does not disclose the interconnected structure in which the compliant layer has pores.

However, Fjelstad discloses the interconnected structure in which the compliant layer comprises various material including material has pores (foam), col. 6 line 32-36. At the time the invention was made; it would have been


obvious to one of ordinary skill in the art to use the compliant material teaching of Fjelstad with Matsuda's device for the intended purpose, MPEP 2144.07.

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao X. Le whose telephone number is (571) 272-1708. The examiner can normally be reached on M-F from 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M. Fahmy can be reached on (571) 272 -1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to be 'Thao X. Le', with a stylized, sweeping underline.

Thao X. Le
30 Aug. 2006